Sandia National Laboratories

Weapons Applications of Geotechnology Program (WAGtech)

Focus

The Weapons Applications of Geotechnology Program, WAGtech, focuses on geo-science and technology (S&T) of a national security nature that supports our nation's nuclear weapons complex, and our military and intelligence services. It includes most of the 6100 efforts sponsored by the Department of Defense (DoD), the National Nuclear Security Administration (NNSA), and national intelligence agencies as well as aspects of domestic "homeland security" that involve similar technology applications.

Center 6100 does not perform the systems integration for the external customer interface. Rather, our funding generally comes through a Sandia program manager in another Division and our work requires extensive partnering with other organizations.

Sandia draws upon the skills of our geoscience cluster of departments to support Nuclear Weapons (NW), DoD, and intelligence community programs in the following areas:

- Geologic Characterization of Underground Facilities
- Component Material Characterization and Modeling
- Space-based and Terrestrial Sensing and Analysis
- Earth Penetration

Our responsiveness and reliability have earned us an internal and external reputation as credible, experienced players. Demonstrated contributions in geophysical imaging, material characterization, data exploitation methods for remotely assessing geologic conditions, and dynamic rock physics are some examples of the specialized expertise we bring to these arenas.
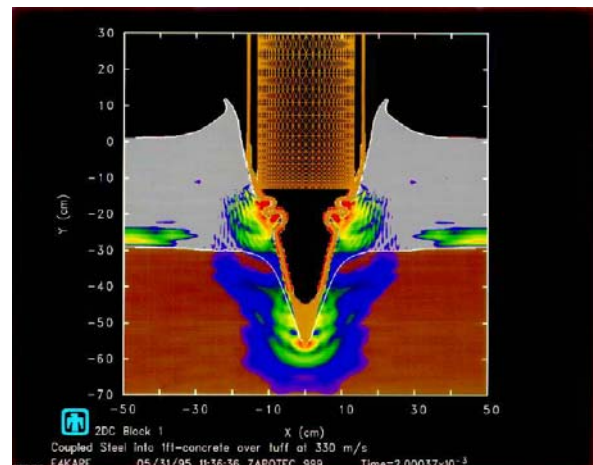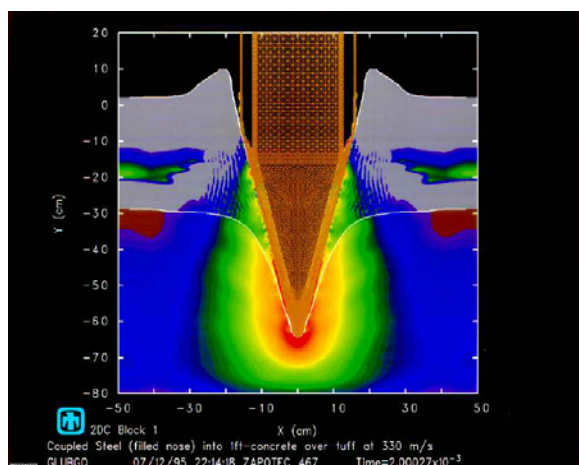
Earth / Concrete Penetration Simulation

WAGtech Selected Projects

Characterization of materials for weapons applications – We support a number of projects to characterize the mechanical behavior of materials used in weapons components and packaging. Materials such as light and dense foams, metal and ceramic powder composites, ceramics, and epoxy fillers are tested in triaxial load space to determine their constitutive behavior under quasi-static to highly dynamic conditions. We also characterize materials over a large range in temperature to ensure their suitability in a weapon environment. We have the unique ability to test materials at -65°C and up to 5Kb of confining pressure.
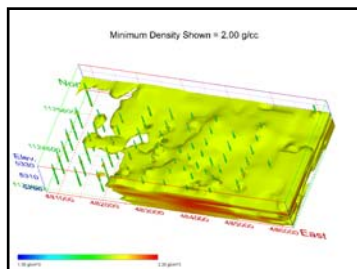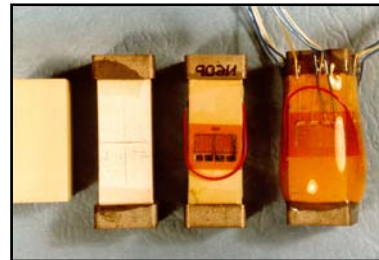

Characterization of geomaterials for weapon test applications – We support ongoing Sandia efforts to improve understanding of the behavior of rock and soil under extreme loading conditions such as those encountered during earth penetration or the propagation of large blast effects. We have a state of the art geomechanics laboratory that can test materials up to 10Kb in confining pressure and apply 1.0 million pounds axial load. We also use split Hopkinson pressure bar apparatus that allows testing of these materials up to10^{3} s^{-1} strain rate with confinement.

Sandia GeoModel – We have developed a comprehensive constitutive model for rock, soil, and other porous, pressure-sensitive materials. This model has been applied to numerous problems ranging from shock interaction with underground facilities and earth penetration to the estimation of stress states in paper products during use.
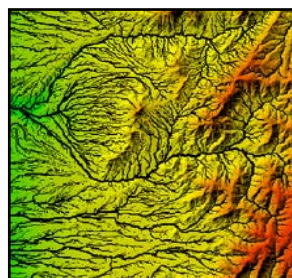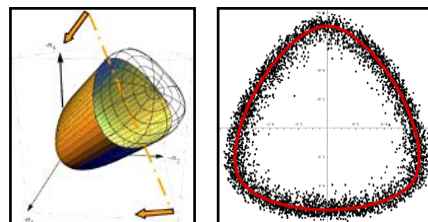
RemoteGeo – We are actively developing methods to improve the geological characterization of facility sites using remote sensing. As part of the Laboratory Directed Research and Development Program, Sandia has developed and demonstrated on-the-ground seismic sensors that can self-network and interrogate near surface geology. This project has also demonstrated prototype air delivery of sensors in highly rugged sensor "darts" that can implant themselves in soil or soft rock. As part of the RemoteGeo concept we are also developing better means of extracting geologic information and material properties from overhead imagery, focusing primarily on multi-spectral, hyper-spectral, and synthetic aperture radar (SAR) technologies.

Response of Geo-structures to severe loading – We support a number of national security efforts to examine the potential effects of terrorist attacks on infrastructure elements such as earthen dams, dikes, and tunnels. Through our unique ability to characterize a variety of materials under dynamic conditions combined with the capability to model complex structures using the Sandia GeoModel, we have participated in a program to predict potential damage to dams and examine options for remediation. Sandia has conducted several scaled tests on dams for comparison to model predictions with favorable results.
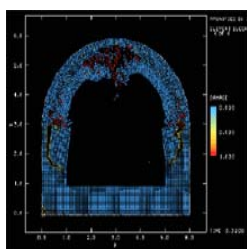
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